

COVID-19 Resource Desk

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New Research

*note, **PREPRINTS** have not undergone formal peer review

COVID-19 related publications by Providence caregivers – see [Digital Commons](#)

Basic Science / Virology / Pre-clinical

- 1. Emergence of a SARS-CoV-2 variant of concern with mutations in spike glycoprotein.** Tegally H, et al. *Nature*. 2021 Mar 9. doi: 10.1038/s41586-021-03402-9.
<https://www.nature.com/articles/s41586-021-03402-9>
Continued uncontrolled transmission of the SARS-CoV-2 in many parts of the world is creating the conditions for significant virus evolution. Here, we describe a new SARS-CoV-2 lineage (501Y.V2) characterised by eight lineage-defining mutations in the spike protein that may have functional significance. This lineage was identified in South Africa after the first epidemic wave in a severely affected metropolitan area, Nelson Mandela Bay, located on the coast of the Eastern Cape Province. This lineage spread rapidly, becoming dominant in the Eastern Cape, Western Cape and KwaZulu-Natal Provinces within weeks. Whilst the full significance of the mutations is yet to be determined, the genomic data, showing the rapid expansion and displacement of other lineages in multiple regions, suggest that this lineage is associated with a selection advantage, most plausibly as a result of increased transmissibility or immune escape.
- 2. Transmission, infectivity, and antibody neutralization of an emerging SARS-CoV-2 variant in California carrying a L452R spike protein mutation.** Deng X et al. *medRxiv PREPRINT*. 2021.03.07.21252647; doi: <https://doi.org/10.1101/2021.03.07.21252647>
We identified a novel SARS-CoV-2 variant by viral whole-genome sequencing of 2,172 nasal/nasopharyngeal swab samples from 44 counties in California. Named B.1.427/B.1.429 to denote its 2 lineages, the variant emerged around May 2020 and increased from 0% to >50% of sequenced cases from September 1, 2020 to January 29, 2021, exhibiting an 18.6-24% increase in transmissibility. The increased prevalence of a more transmissible variant in California associated with decreased antibody neutralization warrants further investigation.
- 3. SARS-CoV-2 within-host diversity and transmission.** Lythgoe KA, et al. *Science* 09 Mar 2021:eabg0821 DOI: 10.1126/science.abg0821
<https://science.sciencemag.org/content/early/2021/03/10/science.abg0821>
Two important determinants of variant spread are how frequently they arise within individuals, and how likely they are to be transmitted. To characterize within-host diversity and transmission we deep-sequenced 1313 clinical samples from the UK. SARS-CoV-2 infections are

characterized by low levels of within-host diversity when viral loads are high, and a narrow bottleneck at transmission. Most variants are either lost, or occasionally fixed, at the point of transmission, with minimal persistence of shared diversity - patterns which are readily observable on the phylogenetic tree. Our results suggest that transmission-enhancing and/or immune-escape variants are likely to arise infrequently but could spread rapidly if successfully transmitted.

4. **Clofazimine broadly inhibits coronaviruses including SARS-CoV-2.** Yuan S, et al. *Nature*. 2021 Mar 16. doi: 10.1038/s41586-021-03431-4. <https://www.nature.com/articles/s41586-021-03431-4> [reference.pdf](#)
We show that clofazimine, an anti-leprosy drug with a favourable safety profile, possesses pan-coronaviral inhibitory activity, and can antagonize SARS-CoV-2 and MERS-CoV replication in multiple in vitro systems. In a hamster model of SARS-CoV-2 pathogenesis, prophylactic or therapeutic administration of clofazimine significantly reduced viral load in the lung and faecal viral shedding, and also mitigated inflammation associated with viral infection. Since clofazimine is orally bioavailable and has a comparatively low manufacturing cost, it is an attractive clinical candidate for outpatient treatment and remdesivir-based combinatorial therapy for hospitalized COVID-19 patients, particularly in developing countries.
5. **Evidence of escape of SARS-CoV-2 variant B.1.351 from natural and vaccine-induced sera.** Zhou D et al. *Cell*. 2021 Feb 23:S0092-8674(21)00226-9. doi: 10.1016/j.cell.2021.02.037. <https://www.sciencedirect.com/science/article/pii/S0092867421002269>
Here, we describe a structure-function analysis of B.1.351 using a large cohort of convalescent and vaccinee serum samples. The receptor-binding domain mutations provide tighter ACE2 binding and widespread escape from monoclonal antibody neutralization largely driven by E484K, although K417N and N501Y act together against some important antibody classes. In a number of cases, it would appear that convalescent and some vaccine serum offers limited protection against this variant.

Clinical Syndrome

6. **COVID-19 and its cardiovascular effects: a systematic review of prevalence studies.** *Cochrane Database Syst Rev*. 2021 Mar 11;3:CD013879. doi: 10.1002/14651858.CD013879. <https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD013879/full>
AUTHORS' CONCLUSIONS: This systematic literature review indicates that cardiometabolic comorbidities are common in people who are hospitalised with a COVID-19 infection, and cardiovascular complications are frequent. We plan to update this review and to conduct a formal meta-analysis of outcomes based on a more homogeneous selected subsample of high-certainty studies.
7. **COVID-19 Associated Pulmonary Aspergillosis in Mechanically Ventilated Patients.** Permpalung N, et al. *Clin Infect Dis*. 2021 Mar 9:ciab223. doi: 10.1093/cid/ciab223. <https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab223/6164950>

People with CAPA had worse outcomes as measured by ordinal severity of disease scores, requiring longer time to improvement and advancing in severity almost twice as fast. People with CAPA were intubated twice as long as those without and had a longer hospital length of stay. CAPA is associated with poor outcomes. Attention towards preventive measures (screening and/or prophylaxis) is warranted in people with high risk.

8. **Association of Acute Symptoms of COVID-19 and Symptoms of Depression in Adults.** Perlis RH, et al. *JAMA Netw Open*. 2021 Mar 1;4(3):e213223. doi: 10.1001/jamanetworkopen.2021.3223. <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777421>
After acute infection with SARS-CoV-2, a subset of individuals experience persistent symptoms involving mood, sleep, anxiety, and fatigue. Among more than 3900 individuals with prior COVID-19 illness surveyed between May 2020 and January 2021, 52.4% met criteria for moderate or greater symptoms of major depression. These symptoms were more likely among younger respondents compared with older respondents and among men compared with women as well as among those with greater self-reported overall COVID-19 severity compared with those with lower severity.
9. **Association of Clinical, Biological, and Brain Magnetic Resonance Imaging Findings with Electroencephalographic Findings for Patients with COVID-19.** CoCo Neurosciences Study Group. *JAMA Netw Open*. 2021 Mar 1;4(3):e211489. doi: 10.1001/jamanetworkopen.2021.1489. <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777441>
There is evidence of central nervous system impairments associated with COVID-19 infection, including encephalopathy. The results from this cohort of patients hospitalized with COVID-19 suggest there are clinical, EEG, and MRI patterns that could delineate specific COVID-19-related encephalopathy and guide treatment strategy.
10. **Acute Ischemic Stroke in Patients with COVID-19: An Analysis from Get with the Guidelines-Stroke.** Srivastava PK, et al. *Stroke*. 2021 Mar 17:STROKEAHA121034301. doi: 10.1161/STROKEAHA.121.034301. <https://www.ahajournals.org/doi/10.1161/STROKEAHA.121.034301>
Compared with patients with AIS/no COVID-19, those with AIS/COVID-19 were younger, more likely to be non-Hispanic Black, Hispanic, or Asian, more likely to present with higher National Institutes of Health Stroke Scale scores and had greater proportions of large vessel occlusions. This analysis demonstrates younger age, greater stroke severity, longer times to evaluation and treatment, and worse morbidity and mortality in patients with AIS/COVID-19 compared with those with AIS/no COVID-19.

Diagnosics & Screening

11. **Clinical prediction rule for SARS-CoV-2 infection from 116 U.S. emergency departments 2-22-2021.** Kline JA, et al. *PLoS One*. 2021 Mar 10;16(3):e0248438. doi:

10.1371/journal.pone.0248438. eCollection 2021.

<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0248438>

We developed a 13-point score: +1 point each for age>50 years, measured temperature>37.5°C, oxygen saturation<95%, Black race, Hispanic or Latino ethnicity, household contact with known or suspected COVID-19, patient reported history of dry cough, anosmia/dysgeusia, myalgias or fever; and -1 point each for White race, no direct contact with infected person, or smoking. Increasing points on the simplified score predicted higher probability of infection (e.g., >75% probability with +5 or more points). Criteria that are available at the point of care can accurately predict the probability of SARS-CoV-2 infection. These criteria could assist with decisions about isolation and testing at high throughput checkpoints.

12. **Thoracic imaging tests for the diagnosis of COVID-19.** Cochrane COVID-19 Diagnostic Test Accuracy Group. *Cochrane Database Syst Rev.* 2021 Mar 16;3:CD013639. doi: 10.1002/14651858.CD013639.pub4. <https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD013639.pub4/full>

AUTHORS' CONCLUSIONS: Our findings indicate that chest CT is sensitive and moderately specific for the diagnosis of COVID-19. Chest X-ray is moderately sensitive and moderately specific for the diagnosis of COVID-19. Ultrasound is sensitive but not specific for the diagnosis of COVID-19. Thus, chest CT and ultrasound may have more utility for excluding COVID-19 than for differentiating SARS-CoV-2 infection from other causes of respiratory illness. Future diagnostic accuracy studies should pre-define positive imaging findings, include direct comparisons of the various modalities of interest in the same participant population, and implement improved reporting practices.

13. **Comparative Analysis of Capillary vs Venous Blood for Serologic Detection of SARS-CoV-2 Antibodies by RPOC Lateral Flow Tests.** Morshed M, et al. *Open Forum Infect Dis.* 2021 Jan 28;8(3):ofab043. doi: 10.1093/ofid/ofab043. eCollection 2021 Mar. <https://academic.oup.com/ofid/article/8/3/ofab043/6122770>

A comparison of rapid point-of-care serology tests using finger prick and venous blood was done on 278 participants. In a laboratory setting, immunoglobulin G (IgG) sensitivity neared 100%; however, IgG sensitivity dramatically dropped (82%) in field testing. Possible factors include finger prick volume variability, hemolysis, cassette readability, and operator training.

Epidemiology & Public Health

14. **Comparison of COVID-19 vaccine prioritization strategies in the United States.** Chapman LAC, et al. *medRxiv PREPRINT.* 2021.03.04.21251264; doi: <https://doi.org/10.1101/2021.03.04.21251264>

A critical question in the COVID-19 pandemic is how to optimally allocate the first available vaccinations to maximize health impact. Targeting older individuals averted the highest proportion of DALYs (40% for 5 million individuals vaccinated) and deaths (65%) but the lowest proportion of cases (12%). Targeting essential workers averted the lowest proportion of DALYs (25%) and deaths (33%). Allocating vaccinations simultaneously by age and location or by age,

sex, race/ethnicity, location, occupation, and comorbidity status averted a significantly higher proportion of DALYs (48% and 56%) than any strategy prioritizing by a single risk factor. Our results corroborate findings of other studies that age targeting is the best single-risk-factor prioritization strategy for averting DALYs and suggest that targeting by multiple risk factors would provide additional benefit.

15. **Racial and Ethnic Disparities in COVID-19 Incidence by Age, Sex, and Period among Persons Aged <25 Years — 16 U.S. Jurisdictions, January 1–December 31, 2020.** Van Dyke ME, Mendoza MC, Li W, et al. *MMWR Morb Mortal Wkly Rep.* ePub: 10 March 2021. DOI: <http://dx.doi.org/10.15585/mmwr.mm7011e1>

Racial and ethnic disparities in COVID-19 incidence among persons aged <25 years in 16 U.S. jurisdictions evolved during the pandemic. Disparities were substantial during January–April and generally decreased during May–December, largely because of a greater increase in incidence among White persons, rather than a decline among racial and ethnic minority groups. The largest persistent disparities involved Native Hawaiian and Pacific Islander, American Indian or Alaska Native, and Hispanic persons. Ensuring equitable and timely access to preventive measures, including testing, safe work and education settings, and vaccination when eligible is important to address racial/ethnic disparities.

16. **Body Mass Index and Risk for COVID-19-Related Hospitalization, Intensive Care Unit Admission, Invasive Mechanical Ventilation, and Death - United States, March-December 2020.** Kompaniyets L, et al. *MMWR Morb Mortal Wkly Rep.* 2021 Mar 12;70(10):355-361. doi: 10.15585/mmwr.mm7010e4. <https://www.cdc.gov/mmwr/volumes/70/wr/mm7010e4.htm> Among 148,494 adults who received a COVID-19 diagnosis at 238 U.S. hospitals during March-December 2020, 28.3% had overweight and 50.8% had obesity. Overweight and obesity were risk factors for invasive mechanical ventilation, and obesity was a risk factor for hospitalization and death, particularly among adults aged <65 years. Risk for invasive mechanical ventilation increased over the full range of BMIs, from 15 kg/m² to 60 kg/m². As clinicians develop care plans for COVID-19 patients, they should consider the risk for severe outcomes in patients with higher BMIs, especially for those with severe obesity.

17. **School reopening without robust COVID-19 mitigation risks accelerating the pandemic.** Gurdasani D, et al. *Lancet.* 2021 Mar 10:S0140-6736(21)00622-X. doi: 10.1016/S0140-6736(21)00622-X. [https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(21\)00622-X/fulltext](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(21)00622-X/fulltext)

Primary and secondary school closures have been associated with substantial reductions over time in the effective reproduction number across many countries and time periods. In contrast, data from the Office for National Statistics' 2020 COVID-19 Infection Survey show that the prevalence of infection among children aged 2–10 years (2%) and 11–16 years (3%) rose above the prevalence for all other age groups before the 2020 Christmas break. Both modelling and real-world data in preprint showing rising cases in regions where the SARS-CoV-2 B.1.1.7 variant was prevalent during the lockdown in November 2020 (when schools were open), suggest that opening all schools now without robust mitigatory measures in place will probably lead to Rt

rising above 1 in almost all scenarios. Recent school outbreaks in northern Italy, where the B.1.1.7 variant is prevalent, are also concerning.

18. **Prevention of COVID-19 among older adults receiving pneumococcal conjugate vaccine suggests interactions between *Streptococcus pneumoniae* and SARS-CoV-2 in the respiratory tract.** Lewnard JA, et al. *J Infect Dis*. 2021 Mar 9;jiab128. doi: 10.1093/infdis/jiab128. <https://academic.oup.com/jid/advance-article/doi/10.1093/infdis/jiab128/6164926>
Reduced risk of COVID-19 among PCV13 recipients, transiently attenuated by antibiotic exposure, suggests pneumococci may interact with SARS-CoV-2.
19. **A majority of uninfected adults show pre-existing antibody reactivity against SARS-CoV-2.** Majdoubi A, et al. *JCI Insight*. 2021 Mar 15:146316. doi: 10.1172/jci.insight.146316. <https://insight.jci.org/articles/view/146316>
We conclude that most adults display pre-existing antibody cross-reactivity against SARS-CoV-2, which further supports investigation of how this may impact the clinical severity of COVID-19 or SARS-CoV-2 vaccine responses.
20. **Seroprevalence of SARS-CoV-2 Antibodies in the US Adult Asymptomatic Population as of September 30, 2020.** Stout RL, Rigatti SJ. *JAMA Netw Open*. 2021 Mar 1;4(3):e211552. doi: 10.1001/jamanetworkopen.2021.1552. <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777502>
Our estimate implied more than twice the number of infections than cases reported to Centers for Disease Control and Prevention, suggesting a more widespread pandemic. The findings of this cross-sectional study suggest that, based on a sample from an otherwise healthy population, the overall number of SARS-CoV-2 infections in the US may be substantially higher than estimates based on public health case reporting.
21. **Increased mortality in community-tested cases of SARS-CoV-2 lineage B.1.1.7.** Davies NG, et al. *Nature*. 2021 Mar 15. doi: 10.1038/s41586-021-03426-1. https://www.nature.com/articles/s41586-021-03426-1_reference.pdf
Here we analyse a dataset linking 2,245,263 positive SARS-CoV-2 community tests and 17,452 COVID-19 deaths in England from 1 September 2020 to 14 February 2021. Based on 4,945 deaths with known SGTF status, we estimate that the hazard of death associated with SGTF is 55% higher. This corresponds to the absolute risk of death for a 55-69-year-old male increasing from 0.6% to 0.9% within 28 days after a positive test in the community. Our analysis suggests that B.1.1.7 is not only more transmissible than preexisting SARS-CoV-2 variants but may also cause more severe illness.
22. **Association of Children’s Mode of School Instruction with Child and Parent Experiences and Well-Being during the COVID-19 Pandemic — COVID Experiences Survey, United States, October 8–November 13, 2020.** Verlenden JV, Pampati S, Raspberry CN, et al. *MMWR Morb Mortal Wkly Rep* 2021;70:369–376. DOI: <http://dx.doi.org/10.15585/mmwr.mm7011a1>
In a probability-based survey of parents of children aged 5–12 years, 45.7% reported that their children received virtual instruction only, 30.9% in-person only, and 23.4% combined virtual

and in-person instruction. Findings suggest that virtual instruction might present more risks than does in-person instruction related to child and parental mental and emotional health and some health-supporting behaviors.

Healthcare Delivery & Healthcare Workers

23. Risk Factors Associated With SARS-CoV-2 Seropositivity Among US Health Care Personnel.

Jacob JT et al. *JAMA Netw Open*. 2021 Mar 1;4(3):e211283. doi: 10.1001/jamanetworkopen.2021.1283.

<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777317>

In this cross-sectional study of US HCP in 3 states, community exposures were associated with seropositivity to SARS-CoV-2, but workplace factors, including workplace role, environment, or contact with patients with known COVID-19, were not. These findings provide reassurance that current infection prevention practices in diverse health care settings are effective in preventing transmission of SARS-CoV-2 from patients to HCP.

24. Impact of the Early Phase of the COVID-19 Pandemic on US Healthcare Workers: Results from the HERO Registry.

HERO Registry Research Group. *J Gen Intern Med*. 2021 Mar 10. doi:

10.1007/s11606-020-06529-z. <https://link.springer.com/article/10.1007/s11606-020-06529-z>

Healthcare workers are at high risk for COVID-19 exposure, but rates of COVID-19 illness were low. The greater risk of COVID-19 infection among race/ethnicity minorities reported in the general population is also seen in healthcare workers. The HERO registry will continue to monitor changes in healthcare worker well-being during the pandemic.

25. Experiences of Latinx Individuals Hospitalized for COVID-19: A Qualitative Study.

Cervantes L, et al. *JAMA Netw Open*. 2021 Mar 1;4(3):e210684. doi: 10.1001/jamanetworkopen.2021.0684.

<https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777402>

In interviews, Latinx patients with COVID-19 who survived hospitalization described initial disease misinformation and economic and immigration fears as having driven exposure and delays in presentation. To confront COVID-19 as a compounder of social disadvantage, public health authorities should mitigate COVID-19-related misinformation, immigration fears, and challenges to health care access, as well as create policies that provide work protection and address economic disadvantages.

26. Impact of COVID-19 Pandemic on Central Line-Associated Bloodstream Infections During the Early Months of 2020, National Healthcare Safety Network.

Patel PR, et al. *Infect Control Hosp Epidemiol*. 2021 Mar 15:1-8. doi: 10.1017/ice.2021.108.

<https://www.cambridge.org/core/journals/infection-control-and-hospital-epidemiology/article/impact-of-covid19-pandemic-on-central-line-associated-bloodstream-infections-during-the-early-months-of-2020-national-healthcare-safety-network/F4FBF17FE70FED931B54097A2AC400C9>

The US national SIR for CLABSIs increased significantly by 28% in 2020 Q2 versus 2019 Q2. Infection control practices changed in many healthcare settings during the pandemic to accommodate increasing numbers of patients and to mitigate shortages of PPE. Reducing the

frequency of contacts with patients and of maintenance activities for central catheters as well as alterations to processes of care all have the potential to contribute to an increase in CLABSIs.

27. Variation in COVID-19 Mortality across 117 US Hospitals in High- and Low-Burden Settings.

Block BL, et al. *J Hosp Med*. 2021 Mar 8. doi: 10.12788/jhm.3612.

<https://www.journalofhospitalmedicine.com/jhospmed/article/237058/hospital-medicine/variation-covid-19-mortality-across-117-us-hospitals-high>

We assessed whether COVID-19 burden was associated with mortality in a large sample of US hospitals. Our study population included 14,226 patients with COVID-19 (median age 66 years, 45.2% women) at 117 hospitals, of whom 20.9% had died at 5 weeks of follow-up. At the hospital level, the observed mortality ranged from 0% to 44.4%. After adjustment for age, sex, and comorbidities, the adjusted odds ratio for in-hospital death in the highest quintile of burden was 1.46 compared to all other quintiles. Still, there was large variability in outcomes, even among hospitals with a similar level of COVID-19 burden and after adjusting for age, sex, and comorbidities.

Prognosis

28. Risk of mortality in patients infected with SARS-CoV-2 variant of concern 202012/1: matched cohort study. Challen R, et al. *BMJ*. 2021 Mar 9;372:n579. doi: 10.1136/bmj.n579.

<https://www.bmj.com/content/372/bmj.n579>

The probability that the risk of mortality is increased by infection with VOC-202012/01 is high. If this finding is generalisable to other populations, infection with VOC-202012/1 has the potential to cause substantial additional mortality compared with previously circulating variants. Healthcare capacity planning and national and international control policies are all impacted by this finding, with increased mortality lending weight to the argument that further coordinated and stringent measures are justified to reduce deaths from SARS-CoV-2.

29. EEG Abnormalities are Common in COVID-19 and are Associated with Outcomes. Lin L et al.

Ann Neurol. 2021 Mar 11. doi: 10.1002/ana.26060.

<https://onlinelibrary.wiley.com/doi/10.1002/ana.26060>

This multi-center retrospective cohort study demonstrates that seizures and other epileptiform abnormalities are common in patients with COVID-19 undergoing clinically-indicated cEEG, and are associated with adverse clinical outcomes.

30. Early prognostication of COVID-19 to guide hospitalisation versus outpatient monitoring using a point-of-test risk prediction score. Chua F et al. *Thorax*. 2021 Mar 10;thoraxjnl-2020-216425. doi: 10.1136/thoraxjnl-2020-216425.

<https://thorax.bmj.com/content/early/2021/03/09/thoraxjnl-2020-216425.citation-tools>

The SOARS score uses constitutive and readily assessed individual characteristics to predict the risk of COVID-19 death. Deployment of the score could potentially inform clinical triage in preadmission settings where expedient and reliable decision-making is key. The resurgence of SARS-CoV-2 transmission provides an opportunity to further validate and update its performance.

31. **Brain and Lung Imaging Correlation in Patients with COVID-19: Could the Severity of Lung Disease Reflect the Prevalence of Acute Abnormalities on Neuroimaging? A Global Multicenter Observational Study.** Mahammedi A et al. *AJNR Am J Neuroradiol*. 2021 Mar 11. doi: 10.3174/ajnr.A7072. <http://www.ajnr.org/content/early/2021/03/11/ajnr.A7072>
The CT lung disease severity score may be predictive of acute abnormalities on neuroimaging in patients with COVID-19 with neurologic manifestations. This can be used as a predictive tool in patient management to improve clinical outcome.

Survivorship & Rehabilitation

32. **Longitudinal assessment of anti-SARS-CoV-2 immune responses for six months based on the clinical severity of COVID-19.** Noh JY, et al. *J Infect Dis*. 2021 Mar 4:jiab124. doi: 10.1093/infdis/jiab124. <https://academic.oup.com/jid/advance-article/doi/10.1093/infdis/jiab124/6158870>
Greater than 85% of patients carry NAb until six months after diagnosis of SARS-CoV-2 infection, providing insights for establishing vaccination strategies against COVID-19.
33. **Timing of surgery following SARS-CoV-2 infection: an international prospective cohort study.** COVIDSurg Collaborative; GlobalSurg Collaborative. *Anaesthesia*. 2021 Mar 9. doi: 10.1111/anae.15458. <https://associationofanaesthetists-publications.onlinelibrary.wiley.com/doi/10.1111/anae.15458>
This international, multicentre, prospective cohort study included patients undergoing elective or emergency surgery during October 2020. Where possible, surgery should be delayed for at least 7 weeks following SARS-CoV-2 infection. Patients with ongoing symptoms \geq 7 weeks from diagnosis may benefit from further delay.
34. **Assessment of Acute Kidney Injury and Longitudinal Kidney Function after Hospital Discharge among Patients with and Without COVID-19.** Nugent J et al. *JAMA Netw Open*. 2021 Mar 1;4(3):e211095. doi: 10.1001/jamanetworkopen.2021.1095. <https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2777315>
In this cohort study of US patients who experienced in-hospital AKI, COVID-19-associated AKI was associated with a greater rate of eGFR decrease after discharge compared with AKI in patients without COVID-19, independent of underlying comorbidities or AKI severity. This eGFR trajectory may reinforce the importance of monitoring kidney function after AKI and studying interventions to limit kidney disease after COVID-19-associated AKI.
35. **Shedding of culturable virus, seroconversion, and 6-month follow-up antibody responses in the first 14 confirmed cases of COVID-19 in the United States.** Killerby ME et al. *J Infect Dis*. 2021 Mar 7:jiab125. doi: 10.1093/infdis/jiab125. <https://academic.oup.com/jid/advance-article/doi/10.1093/infdis/jiab125/6161320>
We aimed to characterize presence of culturable virus in clinical specimens during acute illness, and antibody kinetics up to six months post-onset, among 14 early US COVID-19 patients. Eight participants provided serum at six months post-onset; all retained detectable anti-spike IgG,

and half had detectable neutralizing antibodies. Two participants reported not feeling fully recovered at six months.

36. **Attributes and predictors of long COVID.** Sudre CH et al. *Nat Med.* 2021 Mar 10. doi: 10.1038/s41591-021-01292-y. <https://www.nature.com/articles/s41591-021-01292-y>
We analyzed data from 4,182 incident cases of COVID-19 in which individuals self-reported their symptoms prospectively. A total of 558 (13.3%) participants reported symptoms lasting ≥ 28 days, 189 (4.5%) for ≥ 8 weeks and 95 (2.3%) for ≥ 12 weeks. Long COVID was characterized by symptoms of fatigue, headache, dyspnea and anosmia and was more likely with increasing age and body mass index and female sex. Experiencing more than five symptoms during the first week of illness was associated with long COVID. This model could be used to identify individuals at risk of long COVID for trials of prevention or treatment and to plan education and rehabilitation services.
37. **Antibody Response after SARS-CoV-2 Infection and Implications for Immunity: A Rapid Living Review.** Arkhipova-Jenkins I, et al. *Ann Intern Med.* 2021 Mar 16. doi: 10.7326/M20-7547. <https://www.acpjournals.org/doi/10.7326/M20-7547>
Most adults with SARS-CoV-2 infection confirmed by RT-PCR develop antibodies. Levels of IgM peak early in the disease course and then decline, whereas IgG peaks later and may remain detectable for at least 120 days.
38. **Reinfection Rates among Patients who previously Tested Positive for COVID-19: a Retrospective Cohort Study.** Sheehan MM, Reddy AJ, Rothberg MB. *Clin Infect Dis.* 2021 Mar 15:ciab234. doi: 10.1093/cid/ciab234. <https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab234/6170939>
Prior infection in patients with COVID-19 was highly protective against reinfection and symptomatic disease. This protection increased over time, suggesting that viral shedding or ongoing immune response may persist beyond 90 days and may not represent true reinfection. As vaccine supply is limited, patients with known history of COVID-19 could delay early vaccination to allow for the most vulnerable to access the vaccine and slow transmission.
39. **Four-Month Clinical Status of a Cohort of Patients after Hospitalization for COVID-19.** Writing Committee for the COMEBAC Study Group, *JAMA.* 2021 Mar 17. doi: 10.1001/jama.2021.3331. <https://jamanetwork.com/journals/jama/fullarticle/2777787>
Four months after hospitalization for COVID-19, a cohort of patients frequently reported symptoms not previously present, and lung-scan abnormalities were common among those who were tested. These findings are limited by the absence of a control group and of pre-COVID assessments in this cohort. Further research is needed to understand longer-term outcomes and whether these findings reflect associations with the disease.
40. **Assessment of protection against reinfection with SARS-CoV-2 among 4 million PCR-tested individuals in Denmark in 2020: a population-level observational study.** Holm Hansen C, et al. *Lancet* 2021 Mar 17. doi: [https://doi.org/10.1016/S0140-6736\(21\)00575-4](https://doi.org/10.1016/S0140-6736(21)00575-4)

Protection against repeat infection between first and second COVID-19 surge was 80-5%. Our findings could inform decisions on which groups should be vaccinated and advocate for vaccination of previously infected individuals because natural protection, especially among older people, cannot be relied on.

Therapeutics

41. **A real-life setting evaluation of the effect of remdesivir on viral load in COVID-19 patients admitted to a large tertiary center in Israel.** Goldberg E, et al. *Clin Microbiol Infect.* 2021 Mar 8:S1198-743X(21)00113-0. doi: 10.1016/j.cmi.2021.02.029.
[https://www.clinicalmicrobiologyandinfection.com/article/S1198-743X\(21\)00113-0/fulltext](https://www.clinicalmicrobiologyandinfection.com/article/S1198-743X(21)00113-0/fulltext)
Remdesivir was not associated with nasopharyngeal viral load changes, but our study had a significant disease severity baseline imbalance and was not powered to detect viral load or clinical differences.
42. **Enoxaparin is associated with lower rates of mortality than unfractionated Heparin in hospitalized COVID-19 patients.** Pawlowski C, et al. *EClinicalMedicine.* 2021 Mar 9:100774. doi: 10.1016/j.eclinm.2021.100774. [https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370\(21\)00054-7/fulltext](https://www.thelancet.com/journals/eclinm/article/PIIS2589-5370(21)00054-7/fulltext)
We find that COVID-19 patients administered unfractionated Heparin but not Enoxaparin have higher rates of 28-day mortality. This study emphasizes the need for mechanistically investigating differential modulation of the COVID-associated coagulation cascades by Enoxaparin versus unfractionated Heparin.
43. **Nutrition care practice patterns for patients with COVID-19 - A preliminary report.** Ansu V, et al. *JPEN J Parenter Enteral Nutr.* 2021 Mar 17. doi: 10.1002/jpen.2106.
<https://aspenjournals.onlinelibrary.wiley.com/doi/10.1002/jpen.2106>
This dataset is the first of its kind to report on the types of nutrition diagnoses and interventions for COVID-19 cases used by RDNs and highlights the need for increased and continued nutrition care.
44. **Interleukin-6 blocking agents for treating COVID-19: a living systematic review.** Ghosn L et al. *Cochrane Database Syst Rev.* 2021 Mar 18;3:CD013881. doi: 10.1002/14651858.CD013881.
<https://www.cochranelibrary.com/cdsr/doi/10.1002/14651858.CD013881/full>
AUTHORS' CONCLUSIONS: On average, tocilizumab reduces all-cause mortality at D28 compared to standard care alone or placebo and probably results in slightly fewer serious adverse events than standard care alone or placebo. Nevertheless, tocilizumab probably results in little or no increase in the outcome clinical improvement (defined as hospital discharge or improvement measured by trialist-defined scales) at D28. The impact of tocilizumab on other outcomes is uncertain or very uncertain. Evidence for an effect of sarilumab is uncertain and evidence for other anti-IL6 agents is unavailable. Thirty-nine RCTs of IL-6 blocking agents with no results are currently registered, of which nine are completed and seven trials were terminated with no results available.

45. **Effect of Intermediate-Dose vs Standard-Dose Prophylactic Anticoagulation on Thrombotic Events, Extracorporeal Membrane Oxygenation Treatment, or Mortality among Patients With COVID-19 Admitted to the Intensive Care Unit: The INSPIRATION Randomized Clinical Trial.**

INSPIRATION Investigators. *JAMA*. 2021 Mar 18. doi: 10.1001/jama.2021.4152.

<https://jamanetwork.com/journals/jama/fullarticle/2777829>

Among patients admitted to the ICU with COVID-19, intermediate-dose prophylactic anticoagulation, compared with standard-dose prophylactic anticoagulation, did not result in a significant difference in the primary outcome of a composite of adjudicated venous or arterial thrombosis, treatment with extracorporeal membrane oxygenation, or mortality within 30 days. These results do not support the routine empirical use of intermediate-dose prophylactic anticoagulation in unselected patients admitted to the ICU with COVID-19.

Transmission / Infection Control

46. **Serial interval and incubation period of COVID-19: a systematic review and meta-analysis.**

Alene M, et al. *BMC Infect Dis*. 2021 Mar 11;21(1):257. doi: 10.1186/s12879-021-05950-x.

<https://bmcinfectdis.biomedcentral.com/articles/10.1186/s12879-021-05950-x>

This systematic review and meta-analysis showed that the weighted pooled mean serial interval and incubation period of COVID-19 were 5.2, and 6.5 days, respectively. In this study, the average serial interval of COVID-19 is shorter than the average incubation period, which suggests that substantial numbers of COVID-19 cases will be attributed to presymptomatic transmission.

47. **Transmission of SARS-CoV-2 infection among children in summer schools applying stringent control measures in Barcelona, Spain.** Jordan I et al. *Clin Infect Dis*. 2021 Mar 12:ciab227. doi:

10.1093/cid/ciab227. [https://academic.oup.com/cid/advance-](https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab227/6168543)

[article/doi/10.1093/cid/ciab227/6168543](https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab227/6168543)

The transmission rate of SARS-CoV-2 infection among children attending school-like facilities under strict prevention measures was lower than that reported for the general population. This suggests that under preventive measures schools are unlikely amplifiers of SARS-CoV-2 transmission and supports current recommendations for school opening.

48. **Household SARS-CoV-2 transmission and children: a network prospective study.** COPEDI-CAT research group. *Clin Infect Dis*. 2021 Mar 12:ciab228. doi: 10.1093/cid/ciab228.

<https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab228/6168547>

The study included 1040 COVID-19 patients <16 years. Viral transmission was common among household members (62.3%). More than 70% (756/1040) of pediatric cases were secondary to an adult, whereas 7.7% (80/1040) were index cases. Children are unlikely to cause household COVID-19 clusters or be major drivers of the pandemic even if attending school. Interventions aimed at children are expected to have a small impact on reducing SARS-CoV-2 transmission.

49. **Effectiveness of three versus six feet of physical distancing for controlling spread of COVID-19 among primary and secondary students and staff: A retrospective, state-wide cohort study.**

van den Berg P, et al. *Clin Infect Dis*. 2021 Mar 10:ciab230. doi: 10.1093/cid/ciab230.

<https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab230/6167856>

Among 251 eligible school districts, 537,336 students and 99,390 staff attended in-person instruction during the 16-week study period, representing 6,400,175 student learning weeks and 1,342,574 staff learning weeks. Student case rates were similar in the 242 districts with ≥ 3 feet versus ≥ 6 feet of physical distancing between students. Lower physical distancing policies can be adopted in school settings with masking mandates without negatively impacting student or staff safety.

Vaccines / Immunology

50. **Antibody Responses in Seropositive Persons after a Single Dose of SARS-CoV-2 mRNA Vaccine.**

Krammer F et al. *N Engl J Med*. 2021 Mar 10. doi: 10.1056/NEJMc2101667.

<https://www.nejm.org/doi/10.1056/NEJMc2101667>

We found that a single dose of mRNA vaccine elicited rapid immune responses in seropositive participants, with postvaccination antibody titers that were similar to or exceeded titers found in seronegative participants who received two vaccinations. Whether a single dose of mRNA vaccine provides effective protection in seropositive persons requires investigation.

51. **Sensitivity of SARS-CoV-2 B.1.1.7 to mRNA vaccine-elicited antibodies.**

Collier DA et al. *Nature*. 2021 Mar 11. doi: 10.1038/s41586-021-03412-7. [https://www.nature.com/articles/s41586-](https://www.nature.com/articles/s41586-021-03412-7)

[021-03412-7](https://www.nature.com/articles/s41586-021-03412-7) [reference.pdf](#)

Our data suggest that vaccine escape to current Spike directed vaccines designed against the Wuhan strain will be inevitable, particularly given that E484K is emerging independently and recurrently on a B.1.1.7 (501Y.V1) background and given the rapid global spread of B.1.1.7. Other major variants with E484K such as 501Y.V2 and V3 are also spreading regionally. This should be mitigated by designing next generation vaccines with mutated S sequences and using alternative viral antigens.

52. **Safety and immunogenicity of an inactivated SARS-CoV-2 vaccine, BBV152: interim results from a double-blind, randomised, multicentre, phase 2 trial, and 3-month follow-up of a double-blind, randomised phase 1 trial.**

Ella R et al. *Lancet Infect Dis*. 2021 Mar 8:S1473-3099(21)00070-0. doi: 10.1016/S1473-3099(21)00070-0.

[https://www.thelancet.com/journals/laninf/article/PIIS1473-3099\(21\)00070-0/fulltext](https://www.thelancet.com/journals/laninf/article/PIIS1473-3099(21)00070-0/fulltext)

In the phase 1 trial, BBV152 induced high neutralising antibody responses that remained elevated in all participants at 3 months after the second vaccination. In the phase 2 trial, BBV152 showed better reactogenicity and safety outcomes, and enhanced humoral and cell-mediated immune responses compared with the phase 1 trial. The 6 μ g with Algel-IMDG formulation has been selected for the phase 3 efficacy trial.

53. **Impact of the COVID-19 Vaccine on Asymptomatic Infection Among Patients Undergoing Pre-Procedural COVID-19 Molecular Screening.**

Tande AJ, et al. *Clin Infect Dis*. 2021 Mar

10:ciab229. doi: 10.1093/cid/ciab229. [https://academic.oup.com/cid/advance-](https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab229/6167855)

[article/doi/10.1093/cid/ciab229/6167855](https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab229/6167855)

COVID-19 vaccination with an mRNA-based vaccine showed a significant association with a reduced risk of asymptomatic SARS-CoV-2 infection as measured during pre-procedural molecular screening. The results of this study demonstrate the impact of the vaccines on reduction in asymptomatic infections supplementing the randomized trial results on symptomatic patients.

54. **Immunogenicity of the Ad26.COV2.S Vaccine for COVID-19.** Stephenson KE et al. *JAMA*. 2021 Mar 11. doi: 10.1001/jama.2021.3645. <https://jamanetwork.com/journals/jama/fullarticle/2777598>
In this phase 1 study, a single immunization with Ad26.COV2.S induced rapid binding and neutralization antibody responses as well as cellular immune responses. Two phase 3 clinical trials are currently underway to determine the efficacy of the Ad26.COV2.S vaccine.
55. **Impressive boosting of anti-S1/S2 IgG production in COVID-19-experienced patients after the first shot of the BNT162b2 mRNA COVID-19 Vaccine.** Capetti AF, et al. *Clin Infect Dis*. 2021 Mar 6:ciab214. doi: 10.1093/cid/ciab214. <https://academic.oup.com/cid/advance-article/doi/10.1093/cid/ciab214/6159798>
In COVID-19-experienced subjects a second shot is probably not useful. Given such evidence it is reasonable to reorganize the vaccination campaign, assessing baseline immunity to SARS-CoV-2 through anti-S antibodies. At a time when vaccine demand outstrips supply, adopting this health strategy would help populations achieve herd immunity faster using fewer vaccine doses.
56. **Efficacy of the ChAdOx1 nCoV-19 Covid-19 Vaccine against the B.1.351 Variant.** NGS-SA Group Wits-VIDA COVID Group. *N Engl J Med*. 2021 Mar 16. doi: 10.1056/NEJMoa2102214. <https://www.nejm.org/doi/10.1056/NEJMoa2102214>
A two-dose regimen of the ChAdOx1 nCoV-19 vaccine did not show protection against mild-to-moderate Covid-19 due to the B.1.351 variant.
57. **Immunogenicity of a Single Dose of SARS-CoV-2 Messenger RNA Vaccine in Solid Organ Transplant Recipients.** Boyarsky BJ, et al. *JAMA*. March 15, 2021. doi:10.1001/jama.2021.4385 <https://jamanetwork.com/journals/jama/fullarticle/2777685>
In this study of immunogenicity of the first dose of the mRNA SARS-CoV-2 vaccine among solid organ transplant recipients, the majority of participants did not mount appreciable antispike antibody responses. However, younger participants, those not receiving anti-metabolite maintenance immunosuppression, and those who received mRNA-1273 were more likely to develop antibody responses. These findings of poor antispike antibody responses in organ transplant recipients after the first dose of mRNA vaccines suggest that such patients may remain at higher early risk for COVID-19 despite vaccination.
58. **Effectiveness of the Pfizer-BioNTech COVID-19 Vaccine among Residents of Two Skilled Nursing Facilities Experiencing COVID-19 Outbreaks - Connecticut, December 2020-February 2021.** Britton A, et al. *MMWR Morb Mortal Wkly Rep*. 2021 Mar 19;70(11):396-401. doi: 10.15585/mmwr.mm7011e3. <https://www.cdc.gov/mmwr/volumes/70/wr/mm7011e3.htm>

Partial vaccination, defined as the period from >14 days after the first dose through 7 days after the second dose, had an estimated effectiveness of 63% against SARS-CoV-2 infection among residents within these SNFs. This is similar to estimated effectiveness for a single dose of the Pfizer-BioNTech COVID-19 vaccine in adults across a range of age groups in noncongregate settings and suggests that to optimize vaccine impact among this population, high coverage with the complete 2-dose series should be recommended for SNF residents and staff members.

Women & Children

59. **COVID-19 Infections among Students and Staff in New York City Public Schools.** Varma JK, et al. *Pediatrics*. 2021 Mar 9:e2021050605. doi: 10.1542/peds.2021-050605.
<https://pediatrics.aappublications.org/content/pediatrics/early/2021/03/05/peds.2021-050605.full.pdf>
We found that in-person learning in New York City public schools was not associated with increased prevalence or incidence overall of COVID-19 infection compared with the general community.
60. **Factors linked to severe outcomes in multisystem inflammatory syndrome in children (MIS-C) in the USA: a retrospective surveillance study.** Abrams JY et al. *Lancet Child Adolesc Health* 2021 Mar 9 doi: [https://doi.org/10.1016/S2352-4642\(21\)00050-X](https://doi.org/10.1016/S2352-4642(21)00050-X)
1080 patients met the definition for MIS-C. ICU admission was more likely in patients aged 6–12 years and patients aged 13–20 years, compared with patients aged 0–5 years, and more likely in non-Hispanic Black patients, compared with non-Hispanic White patients. ICU admission was more likely for patients with shortness of breath, abdominal pain, and patients with increased concentrations of C-reactive protein, troponin, ferritin, D-dimer, brain natriuretic peptide (BNP), N-terminal pro B-type BNP, or interleukin-6, or reduced platelet or lymphocyte counts. Coronary artery abnormalities were more common in male patients than in female patients and patients with mucocutaneous lesions or conjunctival injection. Identification of important demographic and clinical characteristics could aid in early recognition and prompt management of severe outcomes for patients with MIS-C.
61. **Adverse Pregnancy Outcomes among Individuals with and Without Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2): A Systematic Review and Meta-analysis.** Huntley BJF, et al. *Obstet Gynecol*. 2021 Mar 10. doi: 10.1097/AOG.0000000000004320.
https://journals.lww.com/greenjournal/Fulltext/9900/Adverse_Pregnancy_Outcomes_Among_Individuals_With.123.aspx
The incidences of intrauterine fetal death and neonatal death were similar among individuals who tested positive compared with negative for SARS-CoV-2 when admitted to labor and delivery. Other immediate outcomes of the newborns were also similar among those born to individuals who tested positive compared with negative for SARS-CoV-2.
62. **Management and Early Outcomes of Neonates Born to Women with SARS-CoV-2 in 16 U.S. Hospitals.** Better Outcomes through Research for Newborns (BORN) Network. *Am J Perinatol*.

2021 Mar 15. doi: 10.1055/s-0041-1726036. <https://www.thieme-connect.com/products/ejournals/abstract/10.1055/s-0041-1726036>

Birth hospitalizations were uncomplicated for late preterm and term infants with maternal COVID-19. · Nursery management of dyads affected by COVID-19 varied between hospitals. Adherence to contemporaneous U.S. clinical guidelines for nursery care was low. Breastfeeding rates were lower for dyads roomed separately than those who were colocated.

GUIDELINES & CONSENSUS STATEMENTS

[Difficult Airway Management in Adult COVID-19 Patients: Statement by the Society of Airway Management.](#) Foley LJ, et al. *Anesth Analg.* 2021 Mar 12. doi: 10.1213/ANE.0000000000005554.

[COVID-19 vaccine guidance for patients with cancer participating in oncology clinical trials.](#) COVID19 and Cancer Clinical Trials Working Group. *Nat Rev Clin Oncol.* 2021 Mar 15:1-7. doi: 10.1038/s41571-021-00487-z.

[American College of Rheumatology Guidance for COVID-19 Vaccination in Patients with Rheumatic and Musculoskeletal Diseases - Version 1.](#) Curtis JR, et al. *Arthritis Rheumatol.* 2021 Mar 17. doi: 10.1002/art.41734.

[Expert consensus statements for the management of COVID-19-related acute respiratory failure using a Delphi method.](#) Nasa P et al. *Crit Care.* 2021 Mar 16;25(1):106. doi: 10.1186/s13054-021-03491-y.

[Differentiation of COVID-19 signs and symptoms from allergic rhinitis and common cold- An ARIA-EAACI-GA\(2\) LEN consensus.](#) Hagemann J et al. *Allergy.* 2021 Mar 17. doi: 10.1111/all.14815.

[SARS-CoV-2 infection, COVID-19 and timing of elective surgery: A multidisciplinary consensus statement on behalf of the Association of Anaesthetists, the Centre for Peri-operative Care, the Federation of Surgical Specialty Associations, the Royal College of Anaesthetists and the Royal College of Surgeons of England.](#) El-Boghdadly K, et al. *Anaesthesia.* 2021 Mar 18. doi: 10.1111/anae.15464.

FDA / CDC / NIH / WHO Updates

CDC - [SARS-CoV-2 Variants](#)

CMS - [Nursing Home Visitation - COVID-19 \(REVISED\)](#)

WHO - [Interim recommendations for the use of the Janssen Ad26.COV2.S \(COVID-19\) vaccine: interim guidance, 17 March 2021](#)

WHO - [Statement of the WHO Global Advisory Committee on Vaccine Safety \(GACVS\) COVID-19 subcommittee on safety signals related to the AstraZeneca COVID-19 vaccine](#)

Commentary & News

[Are some COVID vaccines better than others? Interpreting and comparing estimates of efficacy in trials of COVID-19 vaccines.](#) Rapaka RR, et al. *Clin Infect Dis*. 2021 Mar 6:ciab213. doi: 10.1093/cid/ciab213.

[Novavax Confirms High Levels of Efficacy Against Original and Variant COVID-19 Strains in United Kingdom and South Africa Trials](#)

European Medicines Agency: [COVID-19 Vaccine AstraZeneca: benefits still outweigh the risks despite possible link to rare blood clots with low blood platelets](#)

[Exclusive: AstraZeneca to seek U.S. authorization for COVID-19 vaccine this month or early next - sources](#)

[Covid-19: US Catholics split after bishops' conference recommends against Johnson and Johnson vaccine.](#) Dyer O. *BMJ*. 2021 Mar 9;372:n666. doi: 10.1136/bmj.n666.

[Hunting for a Leftover Vaccine? This Site Will Match You With a Clinic.](#)

[Lilly's bamlanivimab and etesevimab together reduced hospitalizations and death in Phase 3 trial for early COVID-19](#)

[Alternatives to conventional hospitalisation that enhance health systems' capacity to treat COVID-19](#)

[Fact Sheet: President Biden to Announce All Americans to be Eligible for Vaccinations by May 1, Puts the Nation on a Path to Get Closer to Normal by July 4th](#)

[WHO adds Janssen vaccine to list of safe and effective emergency tools against COVID-19](#)

[Moderna Announces First Participants Dosed in Phase 2/3 Study of COVID-19 Vaccine Candidate in Pediatric Population](#)

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